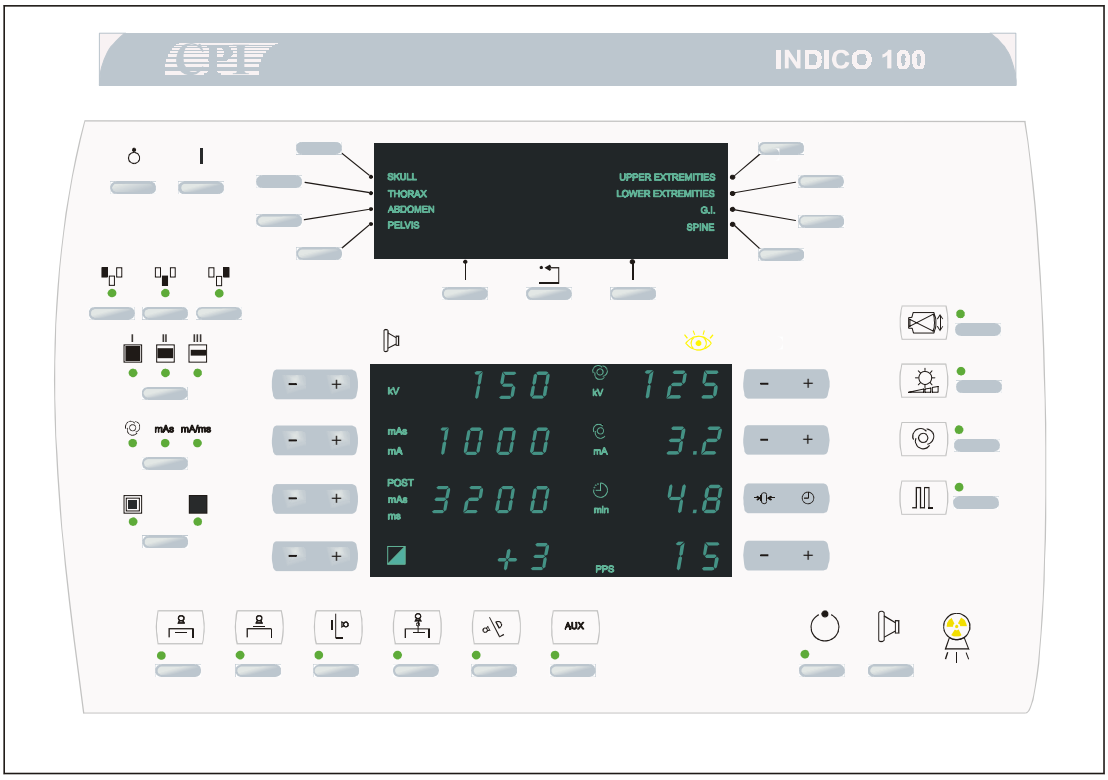
CPI INDICO 100 SERIES

X-RAY GENERATOR



OPERATOR'S MANUAL

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OPERATOR'S MANUAL P/N 740953-00

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INDICO 100 OPERATOR MANUAL

P.N. #740953

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The original version of this manual (15 September 2000)
has been drafted in the English language by:
Communications & Power Industries
communications & medical products division.

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INTRODUCTION 1

Congratulations!

You have acquired the CPI Indico 100 series high frequency X-ray generator. This generator features state-of-the-art computer-based control to ensure minimum patient dose, excellent repeatability, and superior contrast. The operator control functions are designed to be simple and user-friendly.

The AEC (Automatic Exposure Control) and APR (Anatomical Programming) features give you controlled exposure factors, automatically optimized for the radiological study selected.

INDICO 100 MAIN FEATURES

- Models available in maximum output power of 30 to 80 kW, in both radiographic and fluoroscopic models.
- Full 150 kV capability for all models.
- Smaller, lighter modular design.
- Constant dose output due to kVp and mA regulation during exposures.
- User-friendly controls.
- Large LCD panel display for APR and utility routines.
- User-friendly system configuration.
- APR techniques may be modified by the operator.
- ms and mAs limits for AEC may be operator set.
- Provisions for APR / tube downloading.
- Extensive self-diagnostics with operator prompt messages.
- Serial RS232 communications interface.
- May be programmed for APR operation only or both APR and manual technique selection.
- Time and mA / mAs selections are to IEC standards.
- Programmable setup, calibration and APR routines (using an external computer).
- Choice of six fluoro kV to rad kV transfer curves (R & F units only).
- Choice of four kV vs mA curves for ABS (automatic brightness stabilization) circuits (R & F units only).

OPTIONS

- Dual speed starter for automatic high / low speed selection.
- Two-tube capability.
- Pedestal mount for operator control console.
- Automatic Brightness Stabilization (ABS) for consistent imaging (AUTO kV / mA or kV only).
- Remote fluoro controller for R & F table side operation.
- Digital imaging interface.
- Trauma control console.
- Remote exposure hand switch.
- High level fluoro for therapy simulators.

SAFETY NOTICE:	***This manual contains important operating and safety information. An understanding of this information is critical to the safe operation and long term reliability of your equipment. Please ensure that you read the warning notices before using this equipment.***

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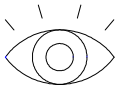
SAFETY AND SPECIFICATIONS 2

Keep this operator's manual with the equipment at all times, and periodically review the operating and safety instructions.

SAFETY / WARNING SYMBOLS

	Warning symbol used to indicate a potential hazard to operators, service personnel or to the equipment. It indicates a requirement to refer to the accompanying documentation for details.
	Radiation exposure symbol used on operator console. Lights to indicate that an exposure is in progress. This is accompanied by an audible tone from the console.
	Fluoro radiation exposure symbol used on operator console and on optional remote fluoro control unit. Lights to indicate that a fluoro exposure is in progress. This is accompanied by an audible tone from the console.
WARNING *THIS X-RAY UNIT MAY BE DANGEROUS TO PATIENT AND OPERATOR UNLESS SAFE EXPOSURE FACTORS AND OPERATING INSTRUCTIONS ARE OBSERVED.*	Radiation warning label on console, used in certain jurisdictions. Never allow unqualified personnel to operate the X-ray generator.

WARNING: ***PROPER USE AND SAFE OPERATING PRACTICES WITH RESPECT TO X-RAY GENERATORS ARE THE RESPONSIBILITY OF THE USERS OF SUCH GENERATORS. CPI CANADA INC. PROVIDES INFORMATION ON ITS PRODUCTS AND ASSOCIATED HAZARDS, BUT ASSUMES NO RESPONSIBILITIES FOR AFTER-SALE OPERATING AND SAFETY PRACTICES.***

CPI CANADA INC. ACCEPTS NO RESPONSIBILITY FOR ANY GENERATOR NOT MAINTAINED OR SERVICED ACCORDING TO THE SERVICE AND INSTALLATION MANUAL OR ANY GENERATOR THAT HAS BEEN MODIFIED IN ANY WAY.

CPI CANADA INC. ALSO ASSUMES NO RESPONSIBILITY FOR X-RAY RADIATION OVEREXPOSURE OF PATIENTS OR PERSONNEL RESULTING FROM POOR OPERATING TECHNIQUES OR PROCEDURES.

WARNING: ***THIS X-RAY UNIT MAY BE DANGEROUS TO PATIENT AND OPERATOR UNLESS SAFE EXPOSURE FACTORS AND OPERATING INSTRUCTIONS ARE OBSERVED.***

X-ray radiation exposure may be damaging to health, with some effects being cumulative and extending over periods of many months or even years. **X-ray operators should avoid any exposure to the primary beam** and take protective measures to safeguard against scatter radiation. Scatter radiation is caused by any object in the path of the primary beam and may be of equal or less intensity than the primary beam that exposes the film.

No practical design can incorporate complete protection for operators or service personnel who do not take adequate safety precautions. **Only authorized and properly trained service and operating personnel should be allowed to work with this X-ray generator equipment.** The appropriate personnel must be made aware of the inherent dangers associated with the servicing of high voltage equipment and the danger of excessive exposure to X-ray radiation during system operation.

- Wear protective clothing. Protective aprons with an equivalent of a minimum of 1/64" (0.35 mm) of lead are recommended.
- To protect the patient against radiation, always use radiation protection accessories in addition to devices which are fitted to the X-ray equipment.
- Keep as large a distance as possible away from the object being exposed and the X-ray tube assembly.
- This X-ray equipment may only be operated in medical rooms which meet IEC requirements.
- Never operate this X-ray equipment in areas where there is a risk of explosion. Detergents and disinfectants, including those used on patients, may create explosive mixtures of gases. Please observe the relevant regulations.
- The operator console, or anything electrically connected to it, must never be used within 6 ft (1.8 m) of the patient environment.
- Only trained maintenance staff may remove the covers of the generator cabinet and the control console.

Do not connect unapproved equipment to the rear of the console: J5 is for the interconnect cable to the generator main cabinet, J2 is a serial port for use by an external computer, and J13 is for connection of an external hand switch and / or foot switch. **INCORRECT CONNECTIONS OR USE OF UNAPPROVED EQUIPMENT MAY RESULT IN INJURY OR EQUIPMENT DAMAGE.**

CONSULT YOUR SERVICE REPRESENTATIVE IF EXTERNAL EQUIPMENT IS TO BE CONNECTED TO THIS SYSTEM. PERIPHERAL DEVICES SHOULD BE IEC 601-1 APPROVED IF LOCATED IN THE PATIENT AREA, AND IEC 950 APPROVED IF OUTSIDE THE PATIENT AREA.

CAUTION: ***DO NOT EXCEED THE TUBE MAXIMUM OPERATING LIMITS SHOWN IN THE SECTION X-RAY TUBE DATA AT THE END OF THE OPERATOR'S MANUAL. INTENDED LIFE AND RELIABILITY WILL NOT BE OBTAINED UNLESS GENERATORS ARE OPERATED WITHIN PUBLISHED SPECIFICATIONS.***

APPLICABLE STANDARDS

The Indico 100 family of generators complies with the following regulatory requirements and design standards:

- FDA Center for Devices & Radiological Health (CDRH) - 21 CFR title 21 subchapter J (USA).
- Radiation Emitting Devices Act - C34 (Canada).
- Medical Device Regulations (Canada).
- EC Directive 93/42/EEC concerning Medical Devices (European Community).

- IEC 601.1, IEC 601.2.7:1998, CSA 601.1, UL2601.1
  -Type of protection against electric shock: Class I equipment.
  -Degree of protection against electric shock: Not classified.
  -Degree of protection against harmful ingress of water: Ordinary equipment.
  -Mode of operation: Continuous operation with intermittent loading (standby - exposure).
  -Equipment not suitable for use in presence of a FLAMMABLE ANESTHETIC MIXTURE WITH AIR OR WITH OXYGEN OR NITROUS OXIDE.

- IEC 601.1.2

  Immunity:

IEC1000-4-2	Electrostatic discharge
IEC1000-4-3	Radiated RF field
IEC1000-4-4	Electrical fast transient
IEC1000-4-5	Surge
IEC1000-4-6	Conducted RF immunity
IEC1000-4-8	Magnetic field immunity
IEC1000-4-11	Voltage dips, interrupts and variations

  Emission:
  EN55011 (CISPR Publications II Emission Standards, Group 1 Class A).

ELECTROMAGNETIC COMPATIBILITY (EMC)

In accordance with the intended use, this X-ray generator complies with the European Council Directive concerning Medical Devices. The CE marking affixed to this product signifies this. One of the harmonized standards of this Directive defines the permitted levels of electromagnetic emission from this equipment and its required immunity from the electromagnetic emissions of other devices.

It is not possible, however, to exclude with absolute certainty the possibility that other high frequency electronic equipment, which is fully compliant to the EMC regulations, will not adversely affect the operation of this generator. If the other equipment has a comparatively high level of transmission power and is in close proximity to the generator, these EMC concerns (the risk of interference) may be more pronounced. It is therefore recommended that the operation of equipment of this type such as mobile telephones, cordless microphones and other similar mobile radio equipment be restricted from the vicinity of this X-ray generator.

OUTPUT PARAMETERS

- kVp range: Radiography 40 to 150 kVp.
  Fluoroscopy 40 to 125 kVp.
- kVp accuracy: ± (5% + 1) kVp.
- mA range: Radiography 10 to 320 mA (30 kW), 10 to 400 mA (37.5 kW), 10 to 630 mA (50 kW), 10 to 800 mA (65 kW), and 10 to 1000 mA (80 kW).
  Fluoroscopy 0.5 to 6.0 mA.
- mA accuracy: ± (5% +1.0) mA for all mA values.
- mAs range: Tube dependent, max 1000 mAs.
- Time range: Radiography 2.0 to 6300 ms.
  Fluoroscopy 0 to 5 or 0 to 10 minutes.
- Lowest current - time product: 0.5 mAs.
- Loading factors which will allow lowest current - time product: All mA values ≤ 250 mA. Refer to table 1 in section 7.

OUTPUT PARAMETERS (Continued)

OUTPUT PARAMETER	MODE	GENERATOR SERIES	LOADING FACTOR
Maximum X-ray tube voltage and highest X-ray tube current at that voltage	Radiographic (Intermittent)	80 kW 65 kW 50 kW 37.5 kW 30 kW	150 kV, 500 mA 150 kV, 400 mA 150 kV, 320 mA 150 kV, 250 mA 150 kV, 200 mA
Maximum X-ray tube voltage and highest X-ray tube current at that voltage	Fluoroscopic (Continuous)	80 kW 65 kW 50 kW 37.5 kW 30 kW	125 kV, 6 mA 125 kV, 6 mA 125 kV, 6 mA 125 kV, 6 mA 125 kV, 6 mA
Maximum X-ray tube current and highest X-ray tube voltage at that current	Radiographic (Intermittent)	80 kW 65 kW 50 kW 37.5 kW 30 kW	1000 mA, 80 kV 800 mA, 80 kV 630 mA, 80 kV 400 mA, 90 kV 320 mA, 90 kV
Maximum X-ray tube current and highest X-ray tube voltage at that current	Fluoroscopic (Continuous)	80 kW 65 kW 50 kW 37.5 kW 30 kW	6 mA, 125 kV 6 mA, 125 kV 6 mA, 125 kV 6 mA, 125 kV 6 mA, 125 kV
Combination of X-ray tube current and X-ray tube voltage resulting in highest output power	Radiographic (Intermittent)	80 kW 65 kW 50 kW 37.5 kW 30 kW	1000 mA, 80 kV 800 mA, 80 kV 630 mA, 80 kV 250 mA, 150 kV 200 mA, 150 kV
Combination of X-ray tube current and X-ray tube voltage resulting in highest output power	Fluoroscopic (Continuous)	80 kW 65 kW 50 kW 37.5 kW 30 kW	6 mA, 125 kV 6 mA, 125 kV 6 mA, 125 kV 6 mA, 125 kV 6 mA, 125 kV
Highest constant output power at 100 kV, 0.1 sec	Radiographic (Intermittent)	80 kW 65 kW 50 kW 37.5 kW 30 kW	80 kW (800 mA, 100 kV, 0.1 s) 63 kW (630 mA, 100 kV, 0.1 s) 50 kW (500 mA, 100 kV, 0.1 s) 32 kW (320 mA, 100 kV, 0.1 s) 25 kW (250 mA, 100 kV, 0.1 s)
Nominal shortest irradiation time (AEC exposures)	AEC	All models	15 ms

ENVIRONMENTAL SPECIFICATIONS

OPERATING

Ambient temperature range:	10 to 40 °C.
Relative humidity:	30 to 75%.
Atmospheric pressure range:	500 to 1060 hPa (375 to 795 mm Hg).

TRANSPORT AND STORAGE

Ambient temperature range:	-20 to 70 °C.
Relative humidity:	10 to 95%, including condensation.
Atmospheric pressure range:	500 to 1060 hPa (375 to 795 mm Hg).

This information is provided to help you establish safe operating conditions for both you and your CPI X-ray generator.

Do not operate this X-ray generator except in accordance with information included in this section, and any additional information provided by the X-ray generator manufacturer and/or competent safety authorities.

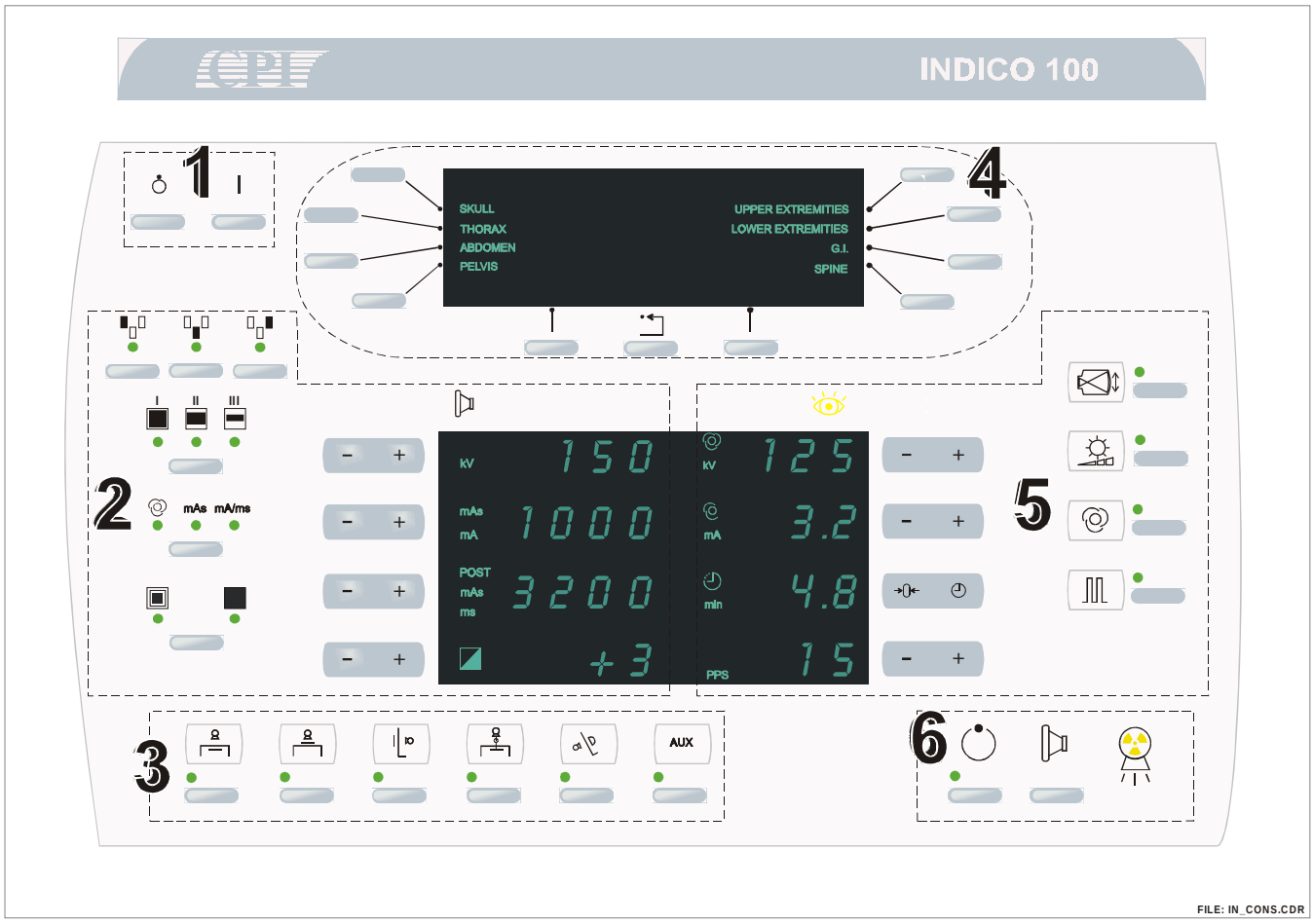
Address any questions regarding X-ray generator operation to:

Marketing Department,
CPI Canada Incorporated,
45 River Drive
Georgetown, Ontario, Canada L7G 2J4

Telephone:	(905) 877-0161.
Fax:	(905) 877-8320 Attention: Customer Support Department
E-mail:	marketing@cmp.cpii.com Attention: Customer Support Department

CONSOLE CONTROLS 3

OPERATOR CONTROL PANEL



1. **Power ON, power OFF buttons.**
2. **Radiography controls and display.**
3. **Image receptor buttons.**
4. **Anatomical programming display and control.**
5. **Fluoroscopy controls and display.**
6. **Prep and exposure buttons and exposure indicator LED.**

NOTE: *THIS MANUAL REFERS TO THE INDICO 100 R & F CONSOLE. FOR RAD ONLY UNITS, IGNORE REFERENCES TO THE FLUOROSCOPY FUNCTION.*

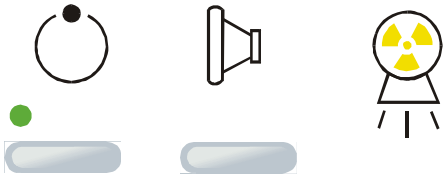
POWER AND EXPOSURE CONTROLS

Power ON / Power OFF buttons

Press | to switch the X-ray generator on. The console will light up and a self check will be performed.

Press ○ to switch the generator off.

Prep / Exposure Buttons and Exposure Indicator LED



Press and hold the prep ○ button to spin the rotor. While pressing the prep button, press and hold the exposure button to make an X-ray exposure.

The X-ray exposure indicator will light when an X-ray exposure is being taken.

Pressing the exposure button only will cycle the generator through prep and then exposure.

When the prep button is pressed, **SPINNING ROTOR** will be displayed in the APR window.

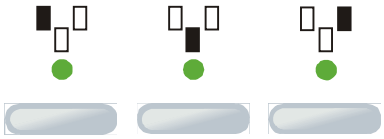
When the prep cycle is complete, **X-RAY READY** will be displayed in the APR window.

During the X-ray exposure, **X-RAY ON** will be displayed in the APR window.

RADIOGRAPHY CONTROLS AND DISPLAY

1. **Field select buttons and indicators (for AEC only).**
2. **Film / Screen select button and indicators (for AEC only).**
3. **Technique select button and indicators.**
4. **Focus select button and indicators.**
5. **kV up / down buttons.**
6. **mA and mAs up / down buttons.**
7. **Time (ms) up / down buttons.**
8. **Density up / down buttons.**
9. **Radiography display panel: kV, mA / mAs, Post mAs / ms, and density.**

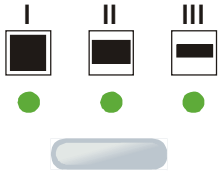
Field Select Buttons and Indicators (for AEC only)



Press the appropriate field select button(s) to select the desired field or combination of fields. The adjacent LED(s) will light to indicate the selected field(s). All three fields may not be deselected.

Operates only when AEC is selected.

Film / Screen Select Button and Indicators (for AEC only)

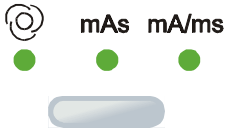


Press the film / screen select button to select the desired film / screen combination. The appropriate LED will light to indicate the desired selection.

- I for film / screen I.
- II for film / screen II.
- III for film / screen III.

Operates only when AEC is selected.

Technique Select Button and Indicators



This function may be disabled in programming.
Press the technique select button until the appropriate LED lights to indicate the desired technique.

- for Automatic Exposure Control (1 point technique).
- **mAs** for mAs technique (2 point technique).
- **mA/ms** for mA and ms technique (3 point technique).

Focus Select Button and Indicators

Press the focus select button until the appropriate LED lights to indicate the desired focal spot.

- for small focus.
- for large focus.

This function may be programmed for auto focal spot selection.

Note: ***The rate of scrolling for the kV, mA and time display increases if the buttons are pressed continuously. To return to the slowest scroll rate, release the button(s) and start again.***

kV up / down buttons and display

To increase kV, press **+**.
To decrease kV, press **-**.

Displays demanded kVp of the exposure.

mA and mAs up / down buttons and display

To increase mA or mAs, press **+**.
To decrease mA or mAs, press **-**.

Displays mA when AEC or mA/ms selected.
Displays mAs when mAs is selected.

Time (ms) up / down buttons and post-mAs / ms display

To increase time (ms), press **+**.
To decrease time (ms), press **-**.

Displays **AEC**, or shows backup mAs or backup ms when AEC selected.
No display when mAs selected.
Displays time (ms) when mA/ms selected.
Displays POST mAs after an AEC exposure is completed.

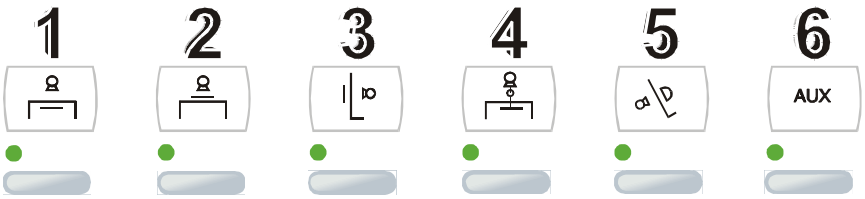
Density up / down buttons and display

Buttons operate only in AEC mode.
To increase dose, press **+**.
To decrease dose, press **-**.

The range is typically -5 to +5. (Installer programmable to have a range of up to -8 to +8).
Varies the optical density by changing the dose.

Each density step will change the dose by approximately 10% (Installer programmable).

IMAGE RECEPTOR BUTTONS AND INDICATORS



1. **Table, with Bucky, image receptor select**
2. **Table, no Bucky, image receptor select**
3. **Vertical image receptor select**
4. **Linear tomographic receptor select**
5. **Under-table R/F and remote R/F select**
6. **Auxiliary image receptor select**

Note: ***Image Receptors (1-6) are depicted as the product is shipped from the factory. These receptors may have been reprogrammed for different functions during installation, and therefore may contain symbols different from those shown.***

Table with Bucky Image Receptor

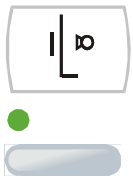
Press this button to select over-table X-ray tube with table image receptor. The adjacent indicator will light.

Used for Bucky / AEC techniques.

Table no Bucky image Receptor

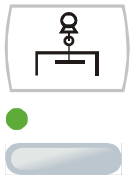
Press this button to select over-table X-ray tube when no image receptor is required. The adjacent indicator will light. Used for table top and off table techniques.

Vertical Image Receptor



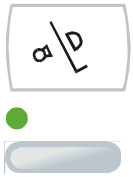
Press this button to select vertical (wall) image receptor or cassette holder. The adjacent indicator will light. Used for Bucky / AEC or cassette only techniques.

Linear Tomographic Receptor



Press this button to select the linear tomographic receptor. The adjacent indicator will light.

Under-Table R/F and Remote R/F



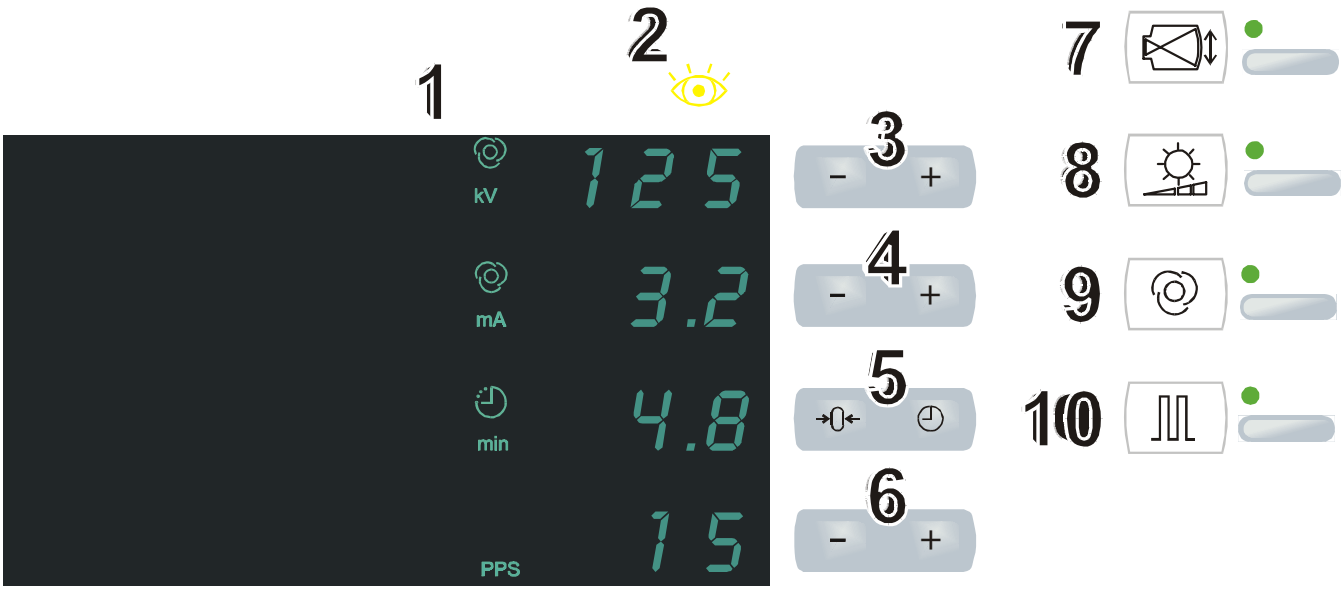
Press this button to select the fluoroscopy function (radiographic / fluoroscopic models only). The adjacent indicator will light and the fluoroscopy display will light.

Auxiliary

Press this button to select the auxiliary image receptor. The adjacent indicator will light. This may be programmed for R & F applications and digital applications.

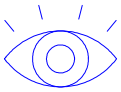
Note: ***The image receptors may have been reprogrammed for your installation.***

FLUOROSCOPY CONTROLS AND DISPLAY



1. **Fluoroscopy display: kV, mA, time (min), PPS**
2. **Fluoro ON indicator**
3. **Fluoro kV up / down buttons**
4. **Fluoro mA up / down buttons**
5. **Time zero and accumulated time buttons**
6. **Pulsed fluoro frame rate buttons**
7. **I.I. magnification select button**
8. **Delta dose select button**
9. **Automatic brightness stabilization (ABS) select button**
10. **Pulse fluoro ON / OFF button**

Fluoro ON Indicator



When fluoro is on, the fluoro "eye" symbol will light. This is accompanied by an audible tone from the console.

Note: ***The fluoro kV and fluoro mA buttons are only functional when ABS is switched OFF.***

Fluoro kV up / down buttons and display

To increase kV, press **+**.
To decrease kV, push **-**.

lit indicates that ABS is selected, manual kV control is therefore not available.

Fluoro mA up / down buttons and display

To increase mA, press **+**.
To decrease mA, press **-**.

lit indicates that ABS is selected, manual mA control is therefore not available.

Time zero and accumulated time buttons and display

To reset the time display to zero, press .

To display accumulated time, press once. The symbol will light to indicate that accumulated time is displayed.

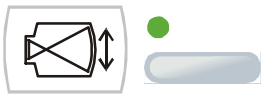
To reset the accumulated time, press when the accumulated time is displayed.

Pulse fluoro frame rate buttons and display

To increase the PPS (Pulses Per Second) rate, press **+**. To decrease the PPS rate, press **-**.

Only active when pulsed fluoro is switched ON.

I.I. magnification select button



Press to select delta I.I. magnification. The relative magnification value is shown in the upper right corner of the LCD display window.

Delta dose select button

Press to select delta dose control function. The delta dose value is shown in the lower right corner of the LCD display.

ABS (Automatic Brightness Stabilization) Select button

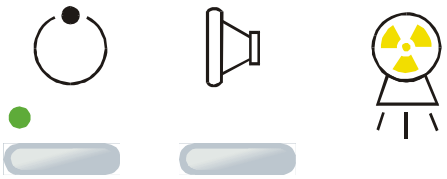
Press to select ABS. The adjacent indicator will light. Switching off ABS will allow the operator to set the fluoro kV and mA manually.

Pulse fluoro ON / OFF button

Press to select pulse fluoro. The adjacent indicator will light.

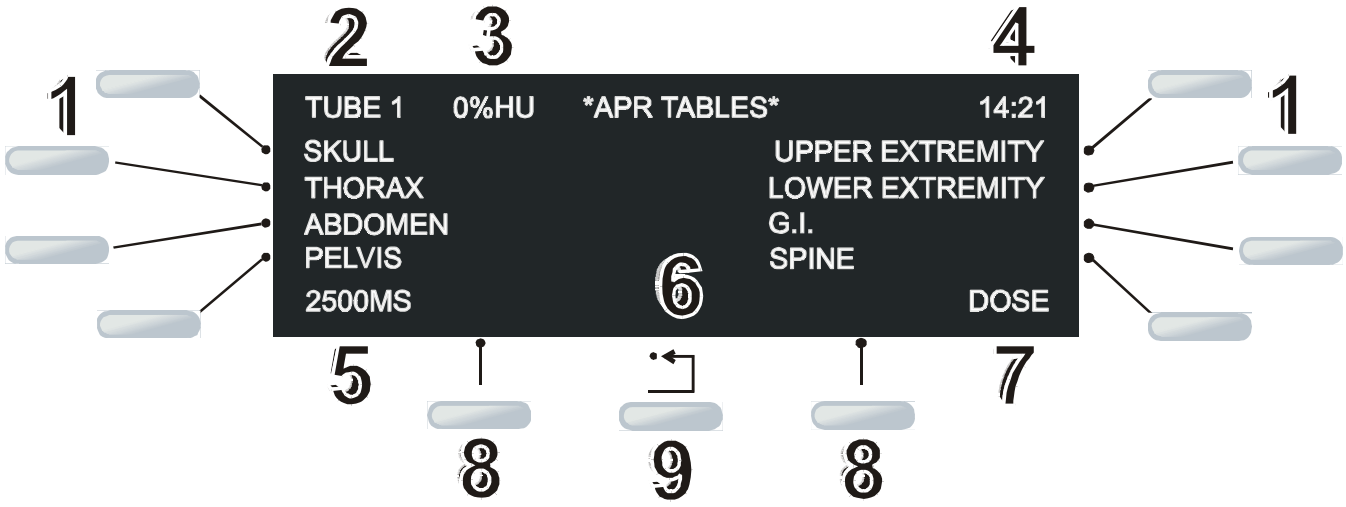
This is only active for optional pulsed fluoro.

Exposure Indicator



The LED adjacent to the prep symbol will light when the foot-switch is pressed for fluoroscopy exposure.
The APR screen will display X-RAY ON. The operator control panel will also indicate the exposure by means of audible beeps.
The rotor may continue to spin briefly after the foot-switch is released (installer programmable).

ANATOMICAL PROGRAMMING CONTROLS AND DISPLAY



THE ABOVE IS A TYPICAL DISPLAY. YOUR UNIT MAY DIFFER DEPENDING ON MODEL, SET-UP, AND PROGRAMMING

1. **Anatomical section and anatomical view selection buttons.**
2. **Tube 1 / tube 2 selection indicator (two tube units only).**
3. **Anode heat indicator (%) readout.**
4. **Time readout - 24 hour mode (RAD only). Displays mag mode in fluoro mode.**
5. **ms/mAs readout.**
6. **Status and operator message display area.**
7. **Dose readout - fluoro only**
8. **Back and next selection buttons**
9. **Reset button.**

Press the button next to the anatomical section required. The APR display will change to show anatomical views within that section. Press the button for the required function. The radiography display will show the programmed X-ray technique factors.
Press the function button again to toggle between normal, large and small patient sizes. The default is normal.
You may override the programmed techniques by selecting + or - for the kV, mA or AEC density. This will **not** change the programmed parameters. To make permanent changes to the APR, see **CHAPTER 5: PROGRAMMING THE CONSOLE.**

%HU indicates the tube anode heat for the selected X-ray tube. An anode heat warning message will be displayed at an installer-programmable level, typically 80 %. Exposures that will exceed a value of typically 90 % will be inhibited (this is also installer programmable).

The current time is displayed in 24 hour format in the upper right corner of the APR window. The time display is replaced by a mag mode indicator when in fluoro operation.

The lower center part of the APR display shows status, warning, and error messages.

The significance of the ms/mAs readout varies depending on mode selected:

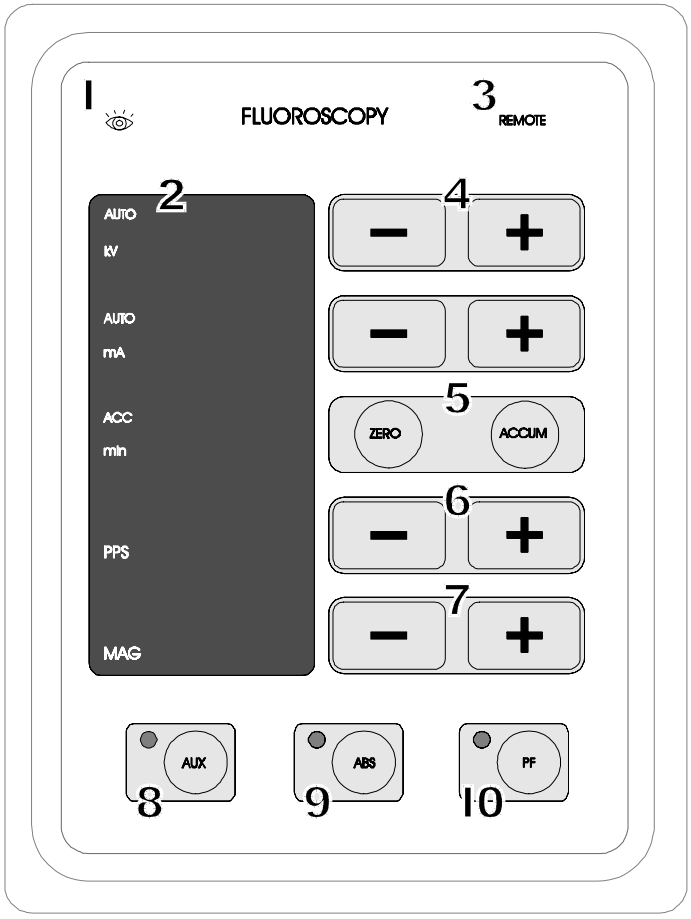
- In AEC mode, with fixed backup time selected, the AEC backup time is displayed.
- In AEC mode, with either variable ms or variable mAs backup time, the backup mAs or ms value is displayed.
- In mAs mode, the time of the exposure will be displayed.
- In mA/ms mode, the calculated mAs of the exposure will be displayed (based on the mA and ms selected).

Press the back and next selection buttons to scroll forward or back through the display. The symbols **<<** or **>>** will be displayed when these buttons are active.

Press the button to return to the main menu, and clear status and error messages.

REMOTE FLUORO CONTROLLER (OPTIONAL) 4

The illustration below shows the remote fluoro controller. This unit allows the operator to select fluoroscopy functions at a location remote from the operator control console. The remote fluoro controller will be energized only when a fluoro technique is selected.



1. **Fluoroscopy exposure indicator**
2. **Fluoro display: kV, mA, time (min), PPS, MAG**
3. **Remote ON indicator**
4. **Decrease / Increase kV and mA buttons**
5. **Time zero / accum time buttons**
6. **Pulsed fluoro rate control**
7. **Magnification control for image intensifier (I.I.)**
8. **Aux button: selects delta dose**
9. **Automatic brightness stabilization (ABS) select button**
10. **Pulsed fluoro select button**

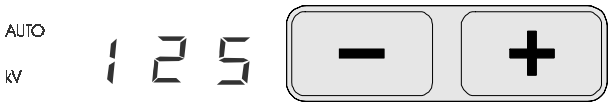
Fluoroscopy must be selected at the operator console to enable the remote fluoro control unit. The default kV and mA will display on both the operator control console and on the remote fluoro unit.

REMOTE FLUORO CONTROLS AND DISPLAY

There are four modes of operation for the unit:

- Manual: - operator controls the exposure
- ABS (Automatic Brightness Stabilization)
- PF (Pulsed Fluoro) optional
- PF with ABS (optional).

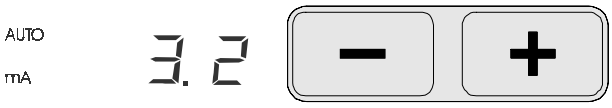
kV selector and display



In manual mode:
To increase kV, press **+**.
To decrease kV, push **-**.

In ABS mode:
The **AUTO** indicator lights and the kV select buttons are inactive.
The display will indicate the kV during the exposure.

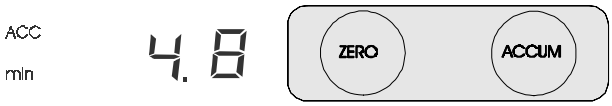
mA selector and display



In manual mode:
To increase mA, press **+**.
To decrease mA, press **-**.

In ABS mode:
The **AUTO** indicator lights and the mA select buttons are inactive.
The display will indicate the mA during the exposure.

Time zero and accumulated time (minutes) display

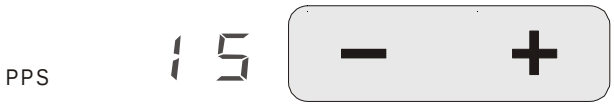


To reset the time display to zero, press **ZERO**.

To display accumulated fluoro exposure time, press **ACCUM**. The **ACC** indicator will light.

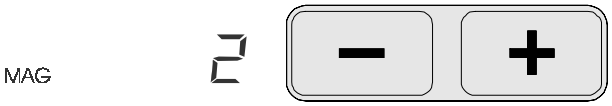
To reset the accumulated time, press **ZERO** when the accumulated time is displayed.

Pulse fluoro frame rate selector and display



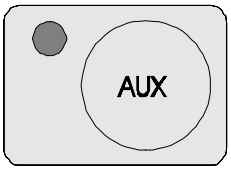
To increase the PPS (Pulses Per Second) rate, press **+**.
To decrease the PPS rate, press **-**.

Mag (magnification) selector and display



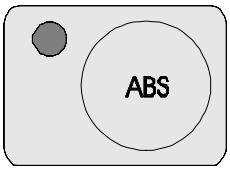
To increase the I.I. (Image Intensifier) magnification, press **+**.
To decrease magnification, press **-**.

Aux Button (Delta Dose Selector)



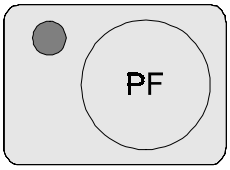
Press this button to select delta dose when ABS is used.
The **ABS** indicator will indicate the selected dose: No flash indicates dose 0, slow flashing indicates dose 1, and fast flashing indicates dose 2.
The remote fluoro control will beep at a slow rate on dose 1, and at a fast rate on dose 2 during a fluoroscopy exposure.

ABS (Automatic Brightness Stabilization) Selector



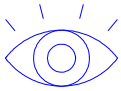
Press this button to select **ABS**. The adjacent indicator will light.
Pressing the button to deselect ABS will extinguish the indicator, and fluoro techniques will be selected manually.

PF (Pulsed Fluoro) Select Button



Selects pulsed fluoro.
Only active for optional pulsed fluoro function.

Fluoroscopy Exposure Indicator



This indicator will light during fluoroscopy exposure. This is accompanied by an audible tone from the console.

Remote ON Indicator

REMOTE When fluoro mode is selected, **REMOTE** will light.

PROGRAMMING THE CONSOLE 5

MAKING CHANGES TO PRE-PROGRAMMED APR TECHNIQUES

The default techniques associated with the anatomical views in the APR display window may be edited if desired. To do this, follow the steps in this chapter.

ENTERING INTO PROGRAMMING MODE

1. Start with the generator switched OFF.
2. Press and hold the ↵ button while pressing the power ON button on the operator console.
3. When the console finishes its power-on sequence, and the ENTER PASSWORD prompt is displayed, press the ↵ button 4 times to access the following menu:

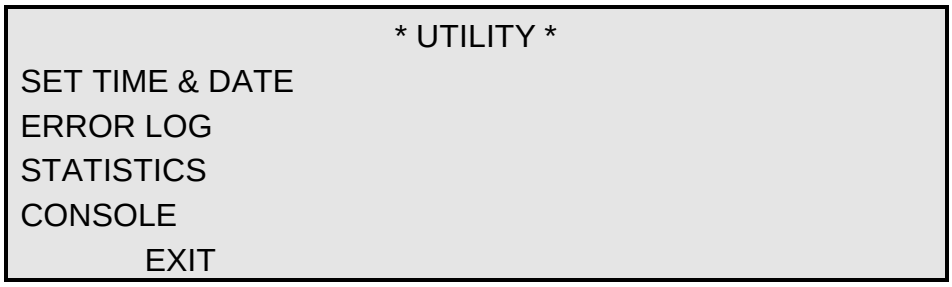
```
                    * GENERATOR SETUP *
UTILITY                          APR EDITOR: DISABLED


EXIT SETUP
```

Access is now provided to the following groups of functions. These will be discussed in sequence.

UTILITY	• Set Time & Date • Error Log • Statistics • Console
APR EDITOR	• Enables/disables changes to the APR techniques
EXIT SETUP	• Returns to normal operation i.e. non programming mode.

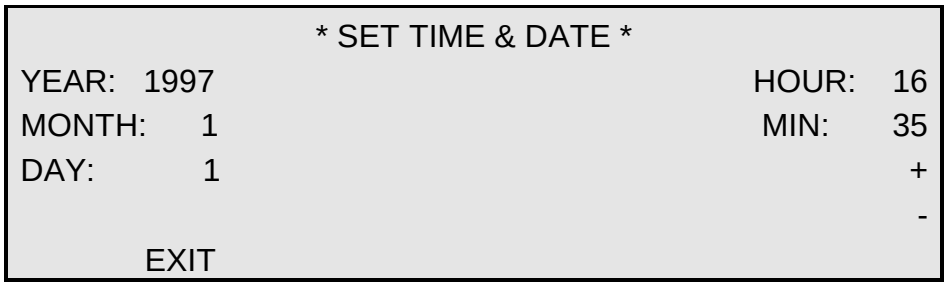
UTILITY MENU

To select the UTILITY menu, press the selection button adjacent to UTILITY in the APR display window. This allows access to the following functions:



SET TIME & DATE	• Allows setting of the time and date
ERROR LOG	• Allows the error log to be reviewed
STATISTICS	• Allows review of the tube exposure counter(s), the fluoro exposure counter if applicable, and the generator accumulated exposure counter.
CONSOLE	• Allows console parameters to be set
EXIT	• Returns to the GENERATOR SETUP menu (previous page)

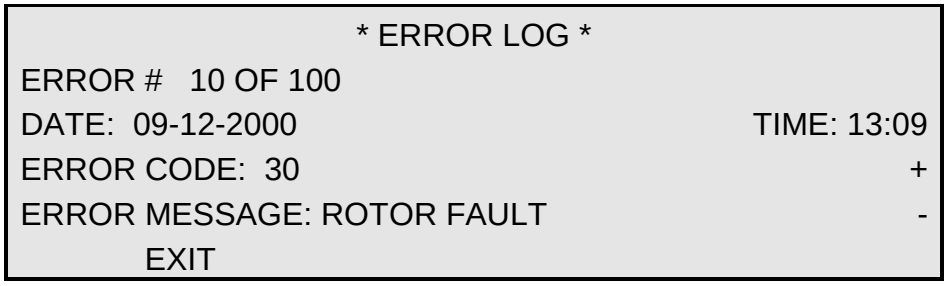
Set Time and Date



Use these steps to set the time and date.

1. From the UTILITY menu, select SET TIME & DATE.
2. Select the parameter to change. Press the **+** or **-** buttons to set the desired value. Time is set in 24 hour format.
3. Select EXIT to return to the UTILITY menu.

Error Log



Use these steps to view the error log.

1. From the UTILITY menu select ERROR LOG**.**
2. Select ERROR # and press the **+** or **-** buttons to scroll through the error log. The error code, error message, date and time of the error will be displayed in the APR display window, and the associated parameters will be displayed on the console displays.
3. Select EXIT to return to the UTILITY menu.

Statistics

The statistics menu shows the tube exposure count, accumulated fluoro hours, and accumulated generator exposure count.

1. From the UTILITY menu select STATISTICS.
2. The statistics (tube 1 exposures, tube 2 exposures if applicable, fluoro hours if applicable, total generator exposures) may now be viewed.
3. Select EXIT to return to the UTILITY menu.

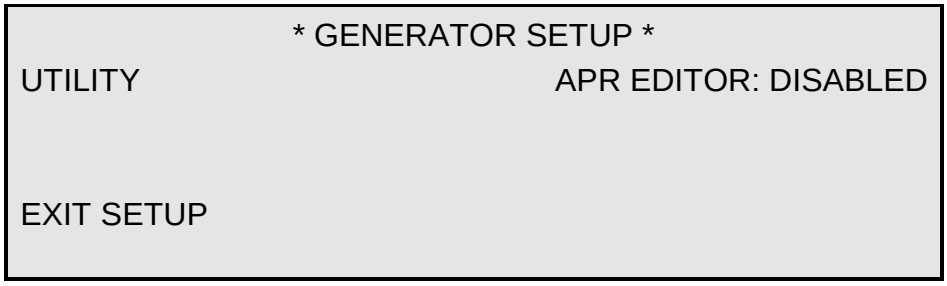
Console

```
                    * CONSOLE *
SLOW KEY REPEAT:  200MS                LCD SCREEN
MED KEY REPEAT:    150MS          APR MODE:    NO
FAST KEY REPEAT:    75MS                       +
SPEAKER VOLUME:    15                          -
          EXIT
```

The CONSOLE menu displays console parameters that may be changed to suit operator preferences.

1. From the UTILITY menu select CONSOLE**.**
2. Select SLOW KEY REPEAT**.** Press the **+** or **-** button to select the speed at which displays change while the button is pressed for the first 5 counts.
3. Select MED KEY REPEAT**.** Press the **+** or **-** button to select the speed at which displays change while the button is pressed for the next 5 counts.
4. Select FAST KEY REPEAT**.** Press the **+** or **-** button to select the speed at which displays change while the button is pressed after 10 counts.
5. Select SPEAKER VOLUME. Press the **+** or **-** button to set the speaker volume in the range 1 to 15.
6. Select LCD SCREEN**.** Press button to toggle between normal and reverse display for the LCD display screen.
7. Select APR MODE. Press selection button to toggle between NO and YES. Selecting YES disallows changes to the / mAs / mA/ms selections when in normal operating mode. This must be set to NO to allow switching between / mAs / mA/ms in normal operating mode.
8. Select EXIT to return to the UTILITY menu.
9. Select EXIT to return to the GENERATOR SETUP menu.

APR EDITOR



Use these steps to edit the programmed APR techniques.

NOTE: BEFORE MAKING CHANGES TO THE DEFAULT APR TECHNIQUES, PLEASE RECORD ALL CURRENT DEFAULTS. THESE DEFAULTS MAY BE RECORDED IN COPIES OF THE APR PROGRAMMING WORKSHEET AT THE END OF THIS CHAPTER.

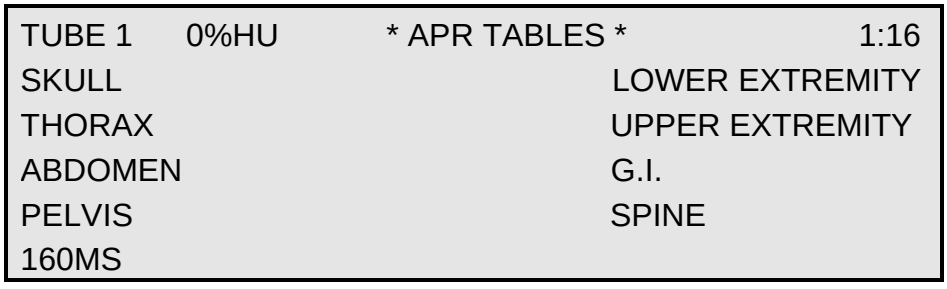
1. From the GENERATOR SETUP menu select APR EDITOR.

2. Press the APR EDITOR button to toggle between ENABLED and DISABLED. DISABLED does not allow editing and then saving the changed APR technique(s). ENABLED allows the operator to change the default APR techniques, and then save the changes. The APR will then default to the newly saved techniques.

   The generator stores the last APR editor setting prior to being switched OFF. If the APR editor was previously ENABLED, APR changes may subsequently be made and then saved in normal operating mode without the need to manually set the APR editor to ENABLED. To disable this feature, the APR editor must be set to DISABLED.

3. With the APR EDITOR set to ENABLED, return to normal operation by pressing EXIT SETUP.

4. The following menu is displayed. This is a typical menu, actual anatomical views may have been reprogrammed, and the screen may differ slightly depending on generator model.



5. Perform the APR technique change as outlined below.
6. Select the desired APR menu to be edited; for example SKULL.
7. Select the desired APR view to edit, for example SKULL AP/PA, vertical image receptor.
8. Select the patient size to edit within that view, for example medium.
   All techniques with the exception of kV will be common to all patient sizes. The common techniques for all patient sizes within that view should be programmed first, then the desired kV for the selected patient size. After these techniques are saved per the remainder of this section, kV values may be programmed if desired for the other patient sizes in the same APR view.
9. The default selections are shown on the console, for example.

   70 kV, 100 mA, 20 ms, technique = mA/ms, large focus.
10. Change the technique to the desired value(s). Parameters that may be edited are: kV, mA/mAs, time (ms), technique select (/ mAs / mA/ms), focus, image receptor, plus film screen, density and field selection in AEC mode.
    The APR view being edited will be highlighted with a rectangular outline as soon as any parameter is changed within that view. Also the word SAVE will appear in the display window above the reset button.
11. Continue making all desired APR changes within that view.
12. When finished, press the button. This is the first step necessary to save the changes. This also allows the option of canceling the changes in the next step.
13. If you do not wish to save the changes, press EXIT to abort the SAVE function. To save the changes, press the button under SAVE. The message SAVING DATA... will briefly appear.
14. Press to return to the main APR screen.
15. You may now make changes to other APR techniques if desired by repeating the above steps 6 to 14.
16. It is suggested that the APR editor be set to DISABLED as described earlier in this section, in order to avoid unintended APR changes in the future.

MAKING CHANGES TO THE APR TEXT

The anatomical sections and views as displayed in the APR window may be altered to suit your requirements, but you will need to contact your service representative to have this done. Use copies of the worksheet on the next page to record your desired changes. One sheet should be used per APR view, the master copy should be photocopied as many times as necessary to record the required changes.

APR PROGRAMMING WORKSHEET (THIS IS A MASTER, MAKE WORKING COPIES AS NEEDED)

INDICO 100 APR PROGRAMMING WORKSHEET

_____	_____
_____	_____
_____	_____
_____	_____

MENU 1
APR TABLES
MAX 16 CHARACTERS

_____	_____
_____	_____
_____	_____
_____	_____

MENU 2
ANATOMICAL VIEW
MAX 16 CHARACTERS

kV	
mA/mAs	
TIME	
DENSITY	

Horizontal Image Receptor	☐
Horizontal Non-Image Receptor	☐
Vertical Image Receptor	☐
Tomography	☐
R/F (Fluoro)	☐
Auxiliary Image Receptor	☐

Patient Size	Small	☐
	Medium	☐
	Large	☐
Tech Select	AEC	☐
	mAs	☐
	mA/TIME	☐
Film Screen	Fast	☐
	Medium	☐
	Detail	☐

Focus	Large	☐
	Small	☐

Field Select ☐ ☐ ☐

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ERROR CODES AND MESSAGES 6

The Indico 100 console will display status messages on the APR display during normal and abnormal operation of the generator. This chapter contains tables of those messages and suggests actions to be taken should any malfunctions occur.
Messages may be cleared by pressing the **RESET** button.

Operator Messages

These messages indicate the status of the generator. No action is required.

MESSAGE	DESCRIPTION
INITIALIZATION	Displayed during power up sequence.
SPINNING ROTOR	Displayed when prep state is active.
X-RAY READY	Displayed when generator is ready to expose
X-RAY ON	Displayed during both a rad and fluoro exposure.

Limit Messages

These messages indicate that an exposure has been requested that exceeds one or more limits.

MESSAGE	PROBLEM	ACTION
TUBE KV LIMIT	Requested kV not allowed as tube kV limit has been reached.	None.
GEN KV LIMIT	Requested kV not allowed as generator kV limit has been reached.	None.
TUBE MA LIMIT	Requested mA not allowed as tube mA limit has been reached.	None.
GEN MA LIMIT	Requested mA not allowed as generator mA limit has been reached.	None.
TUBE KW LIMIT	Requested parameter not allowed as tube kW limit has been reached.	None.
GEN KW LIMIT	Requested parameter not allowed as generator kW limit has been reached.	None.
TUBE MAS LIMIT	Requested mAs not allowed as tube mAs limit has been reached.	None.
GEN MAS LIMIT	Requested mAs not allowed as generator mAs limit has been reached.	None.
GEN MS LIMIT	Requested ms not allowed as generator ms limit has been reached.	None.
CAL LIMIT	Requested parameter not calibrated.	Consult your service representative.

MESSAGE	PROBLEM	ACTION
AEC DENSITY LIM	Requested density not programmed.	Select another density or request those steps be programmed. Consult your service representative for this.
ANODE HEAT WARN	Anode has exceeded programmed warning level.	Wait for anode to cool.
FL TIMER WARN	Fluoro interval timer ≥ 5.0 mins.	Reset fluoro timer.
INVALID PARAM	Generator detected invalid parameter within received message, message ignored.	Select valid parameter.
HOUSE HEAT WARN	X-ray tube housing heat has exceeded housing warning limit.	Wait for housing to cool.
GEN DUTY WARNING	The X-ray generator has exceeded its duty warning limit.	Re-evaluate technique factors. Allow generator to cool if possible. If exposures are continued, serious generator damage may result due to overheating.

Error Messages

These messages indicate that an error has occurred.

ERROR CODE	MESSAGE	PROBLEM	ACTION
E001	GEN EPROM ERR		Consult your service representative.
E003	GEN NVRAM ERR		Consult your service representative.
E004	GEN RTC ERROR	Generator CPU real time clock is not functioning.	Reset time and date. Consult your service representative.
E005	PS CONTACT ERR		Consult your service representative.
E006	ROTOR FAULT		Power unit off and retry rotor start. Consult your service representative.
E007	FILAMENT FAULT		Consult your service representative.
E008	MA FAULT		Consult your service representative.
E009	PS NOT READY	Power supply is not ready to make an exposure.	Retry exposure. Consult your service representative.
E011	HIGH MA FAULT		Consult your service representative.
E012	LOW MA FAULT		Consult your service representative.
E013	MANUAL TERMIN	Operator released exposure switch during exposure.	Re-take exposure if necessary. Consult your service representative.
E014	AEC BUT ERROR	AEC exposure exceeded allowed back up time.	Check exposure technique settings. Consult your service representative.
E015	AEC BU MAS ERR	AEC exposure exceeded allowed back up mAs.	Check exposure technique settings. Consult your service representative.

ERROR CODE	MESSAGE	PROBLEM	ACTION
E016	TOMO BUT ERROR	Tomo exposure exceeded back up time.	1. Check exposure technique settings. 2. Increase tomo back up time if necessary.
E017	NOT CALIBRATED		Consult your service representative.
E018	PREP TIMEOUT	Generator has been in prep state too long.	Reduce length of time in prep state.
E019	ANODE HEAT LIMIT	Selected parameters will cause X-ray tube to exceed its programmed anode heat limit.	Reduce parameters or wait for tube to cool.
E020	THERMAL INT #1	X-ray tube # 1 too hot and its thermal switch has opened.	Wait for X-ray tube # 1 to cool.
E021	THERMAL INT #2	X-ray tube # 2 too hot and its thermal switch has opened.	Wait for X-ray tube # 2 to cool.
E022	DOOR INTERLOCK	Door is open.	Close door.
E023	COLLIMATOR ERR	Collimator is not ready.	Check collimator.
E024	CASSETTE ERROR	Cassette is not ready.	Check cassette.
E025	II SAFETY INT	II safety is not ready.	Check II safety.
E026	SPARE INT	Spare input is not ready.	Consult your service representative.
E028	PREP SW CLOSED		Consult your service representative.
E029	X-RAY SW CLOSED		Consult your service representative.
E030	FLUORO SW CLOSED		Consult your service representative.
E031	REMOTE COMM ERR	Communication error detected with remote fluoro control unit.	Turn power off and then on to Reset Generator. Consult your service representative.
E032	CONSOLE COMM ERR	Generator has detected error in communication to console.	Turn power off and then on to reset generator. Consult your service representative.
E033	GEN BATTERY LOW		Consult your service representative.
E034	+12VDC ERROR		Consult your service representative.
E035	-12VDC ERROR		Consult your service representative.

ERROR CODE	MESSAGE	PROBLEM	ACTION
E036	+15VDC ERROR		Consult your service representative.
E037	-15VDC ERROR		Consult your service representative.
E038	CAL DATA ERROR		Consult your service representative.
E039	AEC DATA ERROR		Consult y our service representative.
E040	FLUORO DATA ERROR		Consult your service representative.
E041	REC DATA ERROR		Consult your service representative.
E042	TUBE DATA ERR		Consult your service representative..
E043	KV ERROR		Switch OFF generator. Prevent further use of generator, then. consult your service representative.
E044	COMM ERROR	Received communication message not valid and ignored.	Reset error.
E045	NOT SUPPORTED	Received message valid, but not supported by this system.	Reset error.
E046	MODE INHIBITED	Received message valid, but not allowed during present state.	Reset error.
E047	FL TIMER LIMIT	Fluoro Timer has exceeded time limit.	Reset Fluoro timer.
E048	FOCUS MISMATCH		Consult your service representative.
E049	NOT ENABLED	Requested function has not been programmed to be enabled.	Consult your service representative.
E050	GEN DATA ERROR		Consult your service representative.
E051	AEC DEVICE ERR	Generator has detected no feedback signal from AEC device.	Check that X-ray tube is pointing at correct AEC device. Consult your service representative.
E052	HIGH SF CURRENT		Consult your service representative.
E053	HIGH LF CURRENT		Consult your service representative.
E054	AEC OUT OF RANGE		Consult your service representative.
E055	NO FIELDS ACTIVE	AEC enabled but no fields are selected.	Select AEC field(s).

ERROR CODE	MESSAGE	PROBLEM	ACTION
E056	NO TUBE SELECTED		Consult your service representative.
E057	AEC STOP ERROR		Consult your service representative.
E058	CONSOLE BUT ERR		Consult your service representative.
E059	HOUSE HEAT LIMIT	X-ray tube housing has exceeded limit.	Wait for tube to cool.
E060	EXP KV HIGH		Consult your service representative.
E061	EXP KV LOW		Consult your service representative.
E062	EXP_ SW ERROR		Consult your service representative.
E063	FACTORY DEFAULTS		Consult your service representative.
E070	SOFTWARE KEY ERR		Consult your service representative.

GENERATOR EXPOSURE TABLES 7

Table 1 following shows mAs values resulting from preselected mA and ms values (3 point operation). This table also shows the range and interrelation of these loading factors. For example, if in AEC operation it is known that the preset backup mAs limit is 50 mAs and 100 mA is chosen for that technique, then the maximum length of exposure possible (at which time the backup mAs limit is reached) is 500 ms.

In the above example, read down the 100 mA column to the 50 mAs value. Then read across to the left side of the page to the 500 ms value, this will be the maximum time allowed for the stated conditions.

Please review the note at the bottom of page 50. This details AEC backup options that are available.

IEC 60601-2-7 requires that this information be provided in a form suitable to be displayed at a prominent location on or near the control console of the generator. To this end, an extra copy of table 1 is provided on pages 46 and 47 which may be photocopied as required, or removed from this manual and placed in a suitable location as per local requirements.

INDICO 100 GENERATOR TECHNIQUE SELECTION
(3 Point Selection: mA/TIME & mAs per IEC)

Time (ms)	mA Selected																
	25	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**
2											**.5**	**.63**	**.8**	**1.0**	**1.2**	**1.6**	**2.0**
2.5										**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**
3.2									**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**
4								**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**
5							**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**
6.3						**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**
8					**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**
10				**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**
12.5			**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**
16		**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**
20	**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**
25	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**
32	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**
40	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**
50	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**
63	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**
80	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**
100	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**
125	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**
160	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
200	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
250	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**
320	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**
400	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**
500	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**

Table 1: mAs values vs. mA & time selected

Table 1 continued on next page

Time (ms)	mA Selected																
	25	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**
630	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**
800	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**
1000	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**
1250	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**	
1600	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**		
2000	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**			
2500	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**				
3200	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**					
4000	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**						
5000	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**							
6300	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**								

Table 1 (Cont): mAs values vs. mA & time selected

Note: ***30 kW Generators*** ***Maximum mA = 320***
37.5 kW Generators ***Maximum mA = 400***
50 kW Generators ***Maximum mA = 630***
65 kW Generators ***Maximum mA = 800***
80 kW Generators ***Maximum mA = 1000***

***Note*:**

1) mA/TIME values are tube rating dependent. For certain tubes, some mA/TIME selections are not available at higher kV selections.

2) The maximum power output of the Indico 100 family of generators is 30 kW, 37.5 kW, 50 kW, 65 kW or 80 kW respectively. The generator software does not allow a kV and mA combination to be selected that exceeds these maximum values.

Time (ms)	mA Selected																
	25	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**
2											**.5**	**.63**	**.8**	**1.0**	**1.2**	**1.6**	**2.0**
2.5										**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**
3.2									**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**
4								**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**
5							**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**
6.3						**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**
8					**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**
10				**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**
12.5			**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**
16		**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**
20	**.5**	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**
25	**.63**	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**
32	**.8**	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**
40	**1.0**	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**
50	**1.25**	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**
63	**1.6**	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**
80	**2.0**	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**
100	**2.5**	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**
125	**3.2**	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**
160	**4.0**	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
200	**5.0**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**
250	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**
320	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**
400	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**
500	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**

Table 1: mAs values vs. mA & time selected

Table 1 continued on next page

Time (ms)	mA Selected																
	25	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**
630	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**
800	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**
1000	**25**	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**
1250	**32**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**	
1600	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**		
2000	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**			
2500	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**				
3200	**80**	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**					
4000	**100**	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**						
5000	**125**	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**							
6300	**160**	**200**	**250**	**320**	**400**	**500**	**630**	**800**	**1000**								

Table 1 (Cont): mAs values vs. mA & time selected

Note: ***30 kW Generators*** ***Maximum mA = 320***
37.5 kW Generators ***Maximum mA = 400***
50 kW Generators ***Maximum mA = 630***
65 kW Generators ***Maximum mA = 800***
80 kW Generators ***Maximum mA = 1000***

***Note*:**

1) mA/TIME values are tube rating dependent. For certain tubes, some mA/TIME selections are not available at higher kV selections.

2) The maximum power output of the Indico 100 family of generators is 30 kW, 37.5 kW, 50 kW, 65 kW or 80 kW respectively. The generator software does not allow a kV and mA combination to be selected that exceeds these maximum values.

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MAINTENANCE SCHEDULE 8

This section is organized into two parts. The first part of this section details tests by which the operator can verify that the AEC and ABS circuits are functioning. These tests should be done monthly as a minimum, or more frequently if required by local regulations.

CAUTION:	***THE AEC AND ABS VERIFICATION PROCEDURES REQUIRE THE PRODUCTION OF X-RAYS. OBSERVE CORRECT OPERATING PROCEDURES, AND TAKE APPROPRIATE PRECAUTIONS AGAINST X-RADIATION.***

The second part of this section is the recommended maintenance schedule for your generator. This maintenance schedule is recommended for all Indico 100 series X-ray generators.

WARNING:	***REFER ALL SERVICING TO APPROPRIATE SERVICE PERSONNEL WHO ARE TRAINED TO SERVICE THIS EQUIPMENT AND WHO ARE FAMILIAR WITH THE POTENTIAL HAZARDS ASSOCIATED WITH THIS EQUIPMENT.***

NOTE:	***MAINTENANCE SCHEDULE FREQUENCY MAY BE DETERMINED BY CERTAIN REGULATORY REQUIREMENTS OF THE COUNTRY OR STATE IN WHICH THE INSTALLATION IS LOCATED. ALWAYS CHECK THE LOCAL CODES AND REGULATIONS WHEN DETERMINING A MAINTENANCE SCHEDULE.***

AEC FUNCTIONAL CHECK

The following procedure may be used to verify that the AEC circuits are functioning on generators equipped with AEC (automatic exposure control).

1. Switch the generator ON, and select an appropriate radiographic image receptor.
2. Align the X-ray tube and the selected image receptor such that the central ray is directly over the center field of the AEC pickup device. Set the focal spot to film plane distance to 40 ″ (1 m).
3. Select AEC mode of operation. Select center field, large focus.

MINIMUM EXPOSURE TIME:

4. With no object in the radiation field, adjust the collimator or beam limiting device to project a 10 ″ X 10 ″ (24 cm X 24 cm) field at the image receptor.
5. Select 80 kVp, 100 mA, and a backup mAs of 50 if it is operator selectable. If this is not operator selectable, the default AEC backup settings must be used. Refer to the note at the end of this page to determine the AEC backup mode that has been programmed.
6. Make an exposure and verify that the POST mAs reading is ≤ 2 mAs.

MAXIMUM EXPOSURE TIME:

7. Close the collimator or beam limiting device completely. Place a folded lead apron over the image receptor.
8. Select 60 kVp, 100 mA, and a backup mAs of 50 if it is operator selectable. If this is not operator selectable, the default backup settings must be used. Refer to the note at the end of this page to determine the AEC backup mode that has been programmed.
9. Make an exposure and verify that the error message **AEC BUT ERROR** or **AEC BU MAS ERR** is indicated in the APR display window after the exposure has terminated. This confirms that the exposure has continued until it was terminated by the AEC backup timer.

NOTE: The AEC backup mode is installer programmable. Three modes are available, **FIXED**, **MAS,** and **MS**. Only the **MAS** mode allows the operator to set the backup mAs for an AEC exposure.

FIXED: The generator will determine the maximum AEC backup time, not to exceed preset AEC backup mAs/ms values or system limits. The characters **AEC** will be displayed in the time window of the LED display during AEC operation.

MAS: Allows the operator to adjust the AEC backup mAs, not to exceed preset AEC backup mAs/ms values or system limits. The mAs value will be displayed in the time window of the LED display during AEC operation.

MS: Allows the operator to adjust the AEC backup ms, not to exceed preset AEC backup mAs/ms values or system limits. The ms value will be displayed in the time window of the LED display during AEC operation.

ABS FUNCTIONAL CHECK

The following procedure may be used to verify that the ABS circuits are functioning on generators equipped with ABS (automatic brightness stabilization).

1. Switch the generator ON, and select an appropriate fluoroscopic image receptor.
2. Select ABS mode. The indicator LED adjacent to the **ABS** selector button on the control console or on the remote fluoro control will be lit to indicate that ABS is ON.
3. Open the collimator or beam limiting device shutters to maximum. With no object in the image field, press the fluoro footswitch. Confirm that the collimator or beam limiting device is fully open by observing the monitor.
4. While continuing to press the fluoro footswitch, note the fluoro kV display at the control console or remote fluoro control. This should be less than 55 kV.
5. Close the collimator or beam limiting device and press the fluoro footswitch. With no object in the image field, ensure that the radiation is fully blocked by observing the monitor. If necessary, cover the image intensifier with lead aprons to block all radiation.
6. While continuing to press the fluoro footswitch, note the fluoro kV display at the control console or remote fluoro control. This should be the maximum available fluoro kV, 110 kV or 125 kV (depending on whether the upper fluoro kV limit has been set to 110 kV or 125 kV).
7. Place an absorber (20 cm of water, or 1.5 ″ (3.8 cm) of pure aluminum, or equivalent) in the center of the image field.
8. Press the fluoro footswitch. While viewing the absorber on the monitor, open the collimator or beam limiting device sufficiently to cover as much of the absorber as possible. Ensure that the X-ray beam does not extend beyond the sides of the absorber as stray radiation will adversely affect the kVp reading in the next step.
9. While continuing to press the fluoro footswitch, note the fluoro kV display at the control console or remote fluoro control. This should stabilize between 70 and 80 kVp.

MAINTENANCE ACTIVITIES IN THE TABLE BELOW ARE TO BE PERFORMED BY AUTHORIZED SERVICE PERSONNEL ONLY. HOWEVER THE ONUS IS ON YOU, THE OWNER OR OPERATOR OF THE EQUIPMENT, TO SCHEDULE THE SUGGESTED MAINTENANCE ACTIVITY WHEN REQUIRED.

Maintenance Frequency	Description of Preventative Maintenance
Every 6 Months AND whenever a related certifiable X-ray component is replaced:	1. Clean and re-grease all HV connections using vapour proof compound. 2. Clean the control console, remote fluoro control (if used) and main cabinet as needed. **REFER TO NEXT PAGE, CLEANING, BEFORE PROCEEDING** 3. Perform the X-ray tube auto calibration routine. 4. Verify the calibration of the generator. 5. Perform any additional tests required by laws governing this installation.
Every 12 months:	1. Examine the following for any visible damage and replace any damaged components: • The exterior of the control console and remote fluoro control if used, including the membrane switch assembly. • The cable between the control console and the generator main cabinet and between the remote fluoro control (if used) and generator main cabinet. • The handswitch and fluoro footswitch (if used) and the cables connecting these to the console. 2. Open the generator cabinet and examine the unit for any visible damage: missing or loose ground connections, oil leaks, damaged cables etc. 3. Ensure that there are no obstructions blocking the ventilation holes at the top of the cabinet, or the louvers on the front door panels.
Every 5 years:	Replace the lithium batteries on the CPU board in the control console and on the generator CPU board in the main cabinet with the same manufacturer and type as identified on the original batteries.

CLEANING

- Never use anything other than soap and water to clean plastic surfaces. Other cleaners may damage the plastic.
- **Never use any corrosive, solvent or abrasive detergents or polishes.**
- Ensure that no water or other liquid can enter any equipment. This precaution prevents short circuits and corrosion forming on components.
- Methods of disinfection used must conform to legal regulations and guidelines regarding disinfection and explosion protection.
- If disinfectants are used which form explosive mixtures of gases, these gases must have evaporated before switching on the equipment again.
- Disinfection by spraying is not recommended because the disinfectant may enter the X-ray equipment.
- If room disinfection is done with an atomizer, it is recommended that the equipment be switched OFF, allowed to cool down and covered with a plastic sheet. When the disinfectant mist has subsided, the plastic sheet may be removed and the equipment be disinfected by wiping.

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X-RAY TUBE DATA 9

CAUTION: ***NOTE TO THE INSTALLER: THE GENERATOR MUST BE PROGRAMMED NOT TO EXCEED THE MAXIMUM OPERATING LIMITS OF THE X-RAY TUBE.***

The following pages contain data for the X-ray tube(s) used with your X-ray generator at the time of installation.

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NOTE TO INSTALLER:

INSERT TUBE DATA HERE.

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